The Race for the First Atomic Bomb

Soon after two German scientists discovered in December 1938 that the element uranium undergoes nuclear fission, or splitting, the scientists of many countries began to warn their respective governments about the potential for building an unthinkably destructive new weapon. Albert Einstein's famous letter was presented to President Franklin D. Roosevelt in October 1939 at the urging of Hungarian physicist Leo Szilard, whose visions of an atomic weapon had been dismissed since 1933 as "moonshine." Though Roosevelt expressed immediate alarm, the U.S. atomic bomb project did not overcome bureaucratic skepticism and inertia until the fall of 1942. By early 1943 the U.S. and British governments had collected ample intelligence that Hitler was actively trying to build a bomb, and the so-called "Manhattan Engineer District" became a top national priority under Army Lt. Gen. Leslie Richard Groves. At a crucial turning point in the U.S. war effort, Groves appointed a U-M professor of physics named Samuel Goudsmit to lead a front-line intelligence mission in Europe to find out if German scientists had provided Hitler with the one weapon that might have changed the course of the war—and history.

Barely a month before World War II broke out in Europe, some of the world's most prominent nuclear physicists were gathered in Ann Arbor for The University of Michigan's annual Summer Symposium in Theoretical Physics. The group included German scientist Werner Heisenberg, winner of the 1933 Nobel Prize and the father of quantum mechanics. As was his custom in Ann Arbor, Heisenberg stayed at the home of his Dutch friend Samuel Goudsmit, a U-M professor he had known well since at least 1928. But within one month Heisenberg would be drafted into the German army, and in almost five years to the day Goudsmit would set out for Europe as the leader of one of the Allies' most important intelligence missions knowing that his main quarry was the man he called his "friend" and "idol."

Their parting of ways began in Ann Arbor, when, well aware of the impending conflagration, Goudsmit and others unsuccessfully tried to convince their German friend to stay in the United States and avoid the wrenching moral dilemma he was to face over the next six years as one of the ranking physicists on the German atomic bomb project.

Goudsmit liked to describe the world of nuclear physics before the war as "the lodge"—a close brotherhood of mentors and friendly rivals who were bonded together beyond national and political boundaries by shared excitement for their emerging, vital field. The University of Michigan and the city of Ann Arbor figured prominently in this heyday of scientific discovery, attracting the world's foremost theoretical physicists to its summer symposium each year. Established in 1928 by

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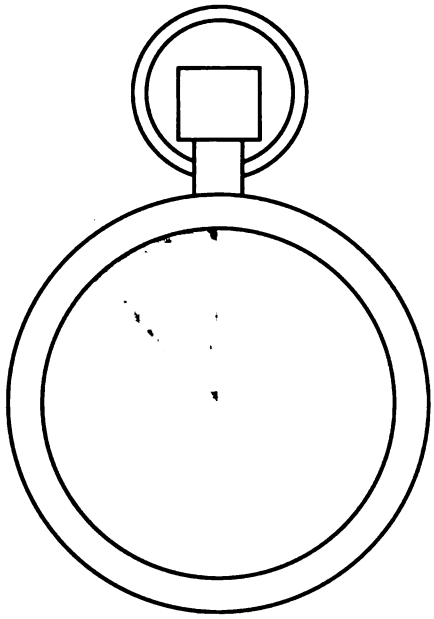

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Harrison Randall, head of the U-M Department of Physics, the roster of symposia guests included Heisenberg as well as most of the other great names from the early history of nuclear physics: P.A.M. Dirac, Paul S. Ehrenfest, Enrico Fermi, Wolfgang Pauli, J.R. Oppenheimer, E.O. Lawrence, Hans Bethe, I.I. Rabi, and Niels Bohr—not to mention the many first-class physicists on the U-M faculty like Goudsmit and his fellow Dutchman George E. Uhlenbeck.

Most of the more gifted scientists spent the 1930s scrupulously avoiding political discussions, hoping against hope that they and their science could remain untouched by the growing danger which ionized the political atmosphere of Europe. Whenever physicists gathered together, their conversation was usually limited to physics and music, the two passions of a physicist. But the summer of 1939 was distinctly different, according to Max Dresden, a physicist at the Stanford Linear Accelerator who has written widely about the history of physics. Dresden had arrived in Ann Arbor that summer from Holland to finish his Ph.D. with Enrico Fermi, and he worked as a waiter at the many social gatherings that took place throughout the summer at the homes of U-M professors. Between the impending war and the possibilities for building a nuclear weapon, says Dresden: "We all knew that physics—and the world—had changed forever."

Fermi had fled Fascist Italy with his Jewish wife directly from Stockholm after receiving the Nobel Prize in physics earlier that year. That spring at Columbia University, Fermi had successfully conducted the first crude experiments towards artificially achieving a nuclear chain reaction. He came to Ann Arbor for the summer to lecture, and he continued to carry on limited experiments and correspondence with Leo Szilard about their work with chain reactions. When Heisenberg turned up in August, Fermi found himself giving another kind of lecture. Dresden remembers the "tense" conversation that took place one late summer evening at the home of U-M Professor Otto LaPorte.

"Fermi and Fermi's wife argued that the only decision a self-respecting scientist could make was to get out of Italy or Germany," Dresden recounted during a telephone interview from his home in California. "They insisted to Heisenberg that no one could maintain any individual or scientific integrity any longer in those countries."

According to Dresden, Heisenberg greatly angered and frustrated his friends in Ann Arbor because of his "refusal, inability, or unwillingness" to address the moral issues they raised. Instead, Heisenberg framed his criticism of the Nazi regime in nationalistic terms, saying only that it was "bad for Germany." Heisenberg was never a member of the Nazi party, and had even publicly criticized *deutsche Physik*—the so-called "German physics," which condemned Einstein's theory of relativity and other "Jewish science." But Heisenberg was a German patriot and volunteer officer in the Alpine reserve forces, and he explained to his friends that "it was the obligation of 'good' Germans to stay and try to modify and alter the regime," according to Dresden, though Heisenberg admitted his influence was limited.

Heisenberg's decision to remain in Germany during the war may be one of those rare cases in history where the actions of one man can affect thousands. "We knew that no one but Professor Heisenberg could be the brains of a German uranium project, and every physicist in the world knew that," Goudsmit writes in *Alsos*, the engaging memoir of his war-time adventures that he published in 1947. Though many Allied scientists had ambivalent feelings about the morality of building an atomic bomb, they worked all the more feverishly because they knew Heisenberg was working on one for the other side.

Goudsmit and The Alsos Mission

By early 1943 Allied scientists feared their German counterparts already had the atomic bomb, and some of them even moved their families from Chicago because they feared that the bomb might be dropped on their secret research facilities there. Rumors also spread that the bomb

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would be dropped on England, or that radioactive poisons would be laid along the path of the planned Allied troop invasion. With six other atomic scientists and about a hundred military men, clerical workers, and scientists in other fields, U-M's Goudsmit was given the job of determining what the Allies were up against. His team followed closely behind invading Allied troops as they marched from the shores of Western Europe toward Berlin, confiscating technical papers at key German-occupied research centers and interrogating and interning scientists working for the Germans on building a bomb. The secret Alsos Mission took its name from the Greek word for "grove," after Lt. Gen. Leslie Richard Groves, chief of the Manhattan Engineer District for the Army.

Goudsmit modestly professed not to understand why he was chosen as the scientific leader of the important Alsos mission, though he was widely considered a top-notch scientist, earning distinction while still a graduate student by discovering the concept of electron spin with fellow student George Uhlenbeck in 1925—a fundamental discovery for which many believed the two Dutchmen deserved a Nobel Prize. Goudsmit also had not participated in the early stages of the U.S. atomic bomb project, so he could not divulge important technical secrets if he were captured in Europe.

Always a lover of mysteries, Goudsmit was a natural for the job of piecing together a picture of the German atomic bomb project from technical papers and apparatus confiscated in the laboratories of occupied countries. Already something of an amateur detective, Goudsmit had taken a course in scientific crime detection in Amsterdam as a young man. In an interview towards the end of his life he said, "I chose physics (because) I failed in detective work." The challenge of deciphering ancient Egyptian hieroglyphics also appealed to Goudsmit's puzzle-solving mind—a skill he liked to say that he stumbled on "by mistake." While a physics student at the University of Leiden, Goudsmit politely accepted an invitation by an Egyptologist to attend his lectures and ended up with two years of private lessons because he was the only student who showed up. He became a lifelong collector and scholar with three published Egyptology articles to his name. (Goudsmit, who died in 1978, willed his valuable collection of Egyptian art and artifacts to U-M's Kelsey Museum, where they are on permanent display.)

Dresden affectionately describes his friend Goudsmit as "very funny, sardonic, infinitely moody, self-deprecating, and very critical of himself and unwilling to put up with pretense," and this warm and thoughtful personality imbues the pages of *Alsos*. Goudsmit also writes with painful honesty of his guilt and sorrow on finding his home in The Hague empty, his parents removed to a Nazi concentration camp just weeks short of Goudsmit bringing them safely to the United States. "The world has always admired the Germans so much for their orderliness," Goudsmit writes. "That is why they kept such precise records of their evil deeds, which we later found in their proper files in Germany. And that is why I know the precise date my father and my blind mother were put to death in the gas chamber. It was my father's seventieth birthday." A mutual friend of Goudsmit and Heisenberg had asked Heisenberg to intervene on behalf of Goudsmit's parents, but it is not clear that Heisenberg ever took action on the request—or if it was even within his ability.

Months before Allied troops invaded the small southern cities in Germany where the most important research installations had been moved in the wake of the heavy Allied bombing of Berlin, Goudsmit and his team had been able to determine that the Nazis were about where the Allies were in 1943—nowhere near having a usable atomic weapon. Heisenberg's laboratory had always been the ultimate target of the mission, and when top military officers entered Heisenberg's office in the small southern village of Hechingen, Heisenberg was not there. But the first thing they saw was a photograph of Heisenberg and Goudsmit standing side by side, taken at the 1939 symposium.

Goudsmit was cordial when Heisenberg was finally brought to him for questioning later in Heidelberg. Goudsmit writes in *Alsos* that he felt a spontaneous need to ask his old friend the same question he had been asking Heisenberg since he stayed with him in Ann Arbor: "Wouldn't you want to come to America now and work with us?" But, according to Goudsmit, Heisenberg stubbornly replied: "No...Germany needs me."

Still under an oath of secrecy at this meeting, Goudsmit deceived Heisenberg about Allied efforts to build a nuclear weapon, and, by all accounts, the top German scientists had no idea that the Allied program was successful until they heard that atomic bombs had been dropped on the Japanese cities of Hiroshima and Nagasaki in August of 1945. Heisenberg and most of the other key German scientists had been interned in a camp in southern England known

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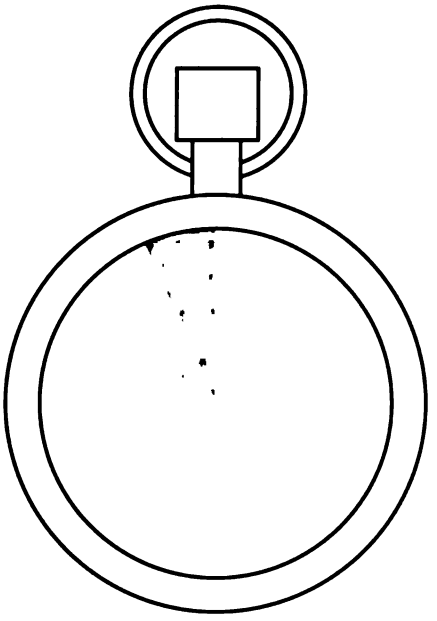

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as Farm Hall, and their reactions following the successful nuclear explosions were reportedly taped by British officials. These tapes, if they exist, have never been released by the British government, but there is a general consensus that the interned German scientists were shocked and disbelieving at first. Dresden and others have interpreted Heisenberg's reaction to the news as a symptom of his "terrible German arrogance."

"I know what Heisenberg was like and the way he thought," says Dresden. "He was terribly competitive and arrogant, and he could not believe the Allies could have achieved something that he and other German scientists could not do."

This "German arrogance" extended even to many non-scientists in Germany who were certain that the bombs dropped on Hiroshima and Nagasaki had been made by German scientists and confiscated by the Allies to use against Japan. Before the war, German had been the *lingua franca* of science, and German scientists had dominated the field of physics. For all else it signified, World War II marked the end of an era in which Europe was considered the center of cutting-edge physics. It also heralded in a new era of increasing militarization of science. Before the war, the U.S. government funded very little scientific research, and physicists prided themselves on getting by with what Goudsmit called "string and sealing wax" to build their experiments. The Manhattan Project had shown the effectiveness of "Big Science"—large teams of scientists funded by large government grants which, Goudsmit and others feared, would always come with strings attached.

Goudsmit writes in *Alsos* of his elation upon first discovering that the Germans did not have the bomb, after all: "Isn't it wonderful that the Germans have no atomic bomb?" he exclaimed to another Alsos scientist. "Now we won't have to use ours." In a two-part profile of Goudsmit that appeared in the *New Yorker Magazine* in 1953, he told of his emotions when he learned that an atomic weapon had been dropped on Hiroshima. "I was angry that the military should have been in a position to keep me in the dark about so momentous an event involving my science. But I realized that much more of the same thing was in store for physicists in the years ahead. And I realized, too, that the days of the lodge were over."

Nazi Collaborator or Saboteur?

In *Alsos*, as well as numerous articles and interviews in the *New York Times* and other publications immediately after the war, Goudsmit used the German scientific defeat to make a moral lesson about the inferiority of science in a totalitarian society. "Heisenberg is a man of ideals," Goudsmit wrote, "but ideals distorted by extreme nationalism and a fanatical belief in his own mission for Germany."

Heisenberg resented Goudsmit's very public attempts to make an example of him and other German scientists, and he took up the subject in a 1946 article in which he seemed to imply that he and other German scientists had known very well how to make a bomb for Hitler, but deliberately had stalled its development. This notion in turn enraged Goudsmit, not only because it contradicted documents he and his team had confiscated in Germany, but because it even seemed to take the high moral ground towards Allied scientists who had successfully developed the weapons used to destroy two heavily populated cities.

In a fascinating series of correspondence between the two former friends, on record at the Neils Bohr Library of the American Institute of Physics in New York, Heisenberg seems more interested in defending his scientific reputation against Goudsmit's portrayal of German incompetence than in addressing the moral issues raised by Goudsmit. By turn polite and reproachful, Goudsmit and Heisenberg continued to exchange letters between 1947 and 1949, with Goudsmit consistently denigrating the German's scientific achievements, and Heisenberg refusing to address moral issues until Goudsmit corrected the record and acknowledged the limited German scientific success. By 1949, both men sensed they were at loggerheads with each other, and, hurt and more

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embittered by the war than ever, they agreed to limit any further discussions to physics. Heisenberg visited Goudsmit on Long Island in 1949, but the close friendship between the two men was never restored, according to Goudsmit's daughter, Esther Goudsmit, '55, M.S. '59, Ph.D. '64, now a professor of biology at Oakland University in Rochester, MI.

Esther, who was born in 1933, says her father did not hold a grudge against Heisenberg, but he never forgave the Nazis for the death of his parents. "I remember my father sobbing in my mother's arms when he received the last letter from his parents," she said. "I don't think he ever found peace with it."

In recent years scholars and journalists have resurrected the debate between Heisenberg and Goudsmit. Historian Mark Walker disputes Goudsmit's claims of German incompetence in his 1989 book, *German National Socialism and the Quest for Nuclear Power*. Instead, he takes the argument that war-time Germany was incapable of launching a large-scale industrial effort such as the United States dedicated to building an atomic weapon. Walker also de-emphasizes Heisenberg's importance in the German atomic weapons program. Author Tom Powers says he has uncovered new evidence for his book, scheduled for publication by Alfred P. Knopf this fall, that Heisenberg used his influence to actively try to sabotage Hitler's bomb project. In a phone interview, Powers stated that he believes Heisenberg was a hero who risked all to set the Nazis on the wrong scientific track, then spent the rest of his life enduring the deep misunderstanding and mistrust of former friends like Goudsmit.

In a 1977 letter to his friend Rudolf Peierls, Goudsmit commented on remarks that he had become "softer" on Heisenberg since his 1947 book. The letter, now at the Niels Bohr Library, reads, in part: "I have had time to think. I believe that we resent that this great physicist, our idol, wasn't any better than we are, that he didn't present the humane leadership we hoped for. Did anyone among our prominent colleagues?"

The debate between Heisenberg and Goudsmit has continued unabated since World War II and had its beginnings long before, as scientists and others have always grappled with the moral dimensions of war and the concept of patriotic duty. But the debate took on new complications and responsibilities for the twentieth-century scientist.

Some, like U-M Professor of Physics H.R. Crane, do not believe it is a scientist's job to tackle such issues. Crane worked on developing the proximity fuse during World War II and says he "had no question it was the right thing to do." He adds that he doesn't understand the protestors who pressured the U-M to divest itself in 1972 of Willow Run Laboratories, where most defense research was conducted. "The country has to have a defense establishment, and if everybody felt that way we wouldn't have any defense," he said.

Others, like U-M Professor of Physics Gordon Kane, believe that all undergraduate physics students should be exposed to discussions of the moral issues raised by science. He remembers how several of his students left the U-M without their Ph.Ds during the Vietnam War, and went to work for weapons labs to avoid the draft. "They got themselves into tricky situations psychologically," said Kane. "They had families to support, yet they had deep questions about the kind of work they were doing. They experienced a real cognitive dissonance."

During the 1960s and 1970s, Kane unsuccessfully tried to convince the department of physics to require a course in the moral dimensions of science, and he still thinks such a course is needed today. "We need to get scientists to think about the consequences of their research and publicize it," he said.

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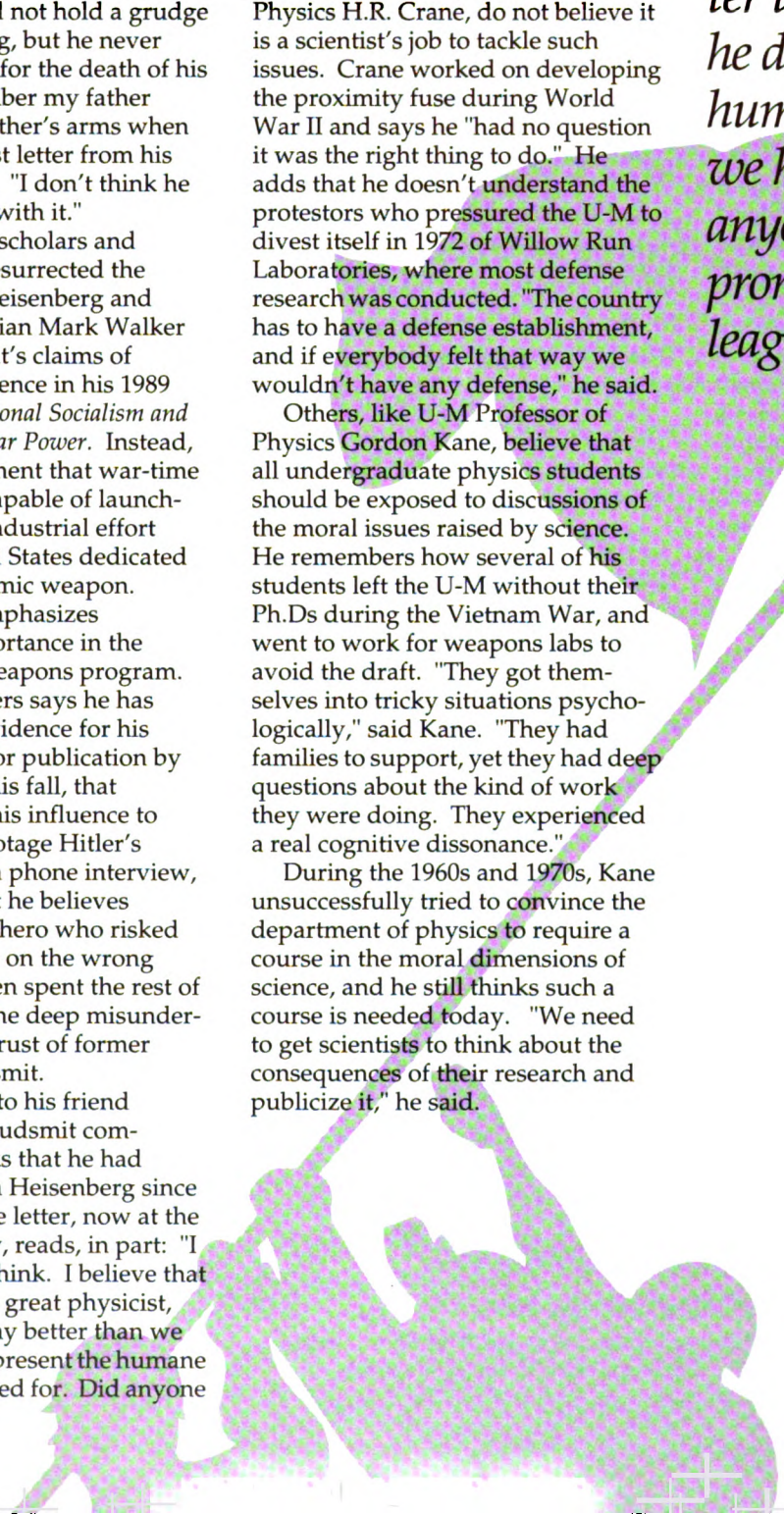

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